AN EVALUATION OF ADIPOSE FIN CLIP VERSUS LEFT VENTRAL FIN CLIP AS MASS MARKS FOR HATCHERY SPRING CHINOOK SALMON AT KOOSKIA NFH, IDAHO

Final Report

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Introduction

With the recent listing of chinook salmon in the Snake River as endangered under the Endangered Species Act of 1973, most Federal, State and Tribal agencies have recognized the need for some kind of mass mark to differentiate hatchery and wild chinook salmon. The Pacific States Marine Fisheries Commission (PSMFC) met during March 1992 to discuss recent progress in fisheries mass marking technology and concluded that further evaluation of mass marks needed to be conducted. The PSMFC decided that the Subcommittee on Mass Marking (Committee) was the logical group to coordinate evaluations and provide recommendations (Appendix I).

Subsequently, the Committee recommended that several marks and tags be evaluated, including ventral fin clipping. Considerable discussion has been held about the suitability of using ventral fin clipping as a mass mark to identify hatchery fish or as an alternative secondary mark to flag fish with coded-wire tags. Currently, surgical removal of the adipose fin has been designated by the Committee as the secondary associated mark to facilitate visual detection of coded-wire tagged chinook salmon. Since all of the hatchery spring chinook salmon to be released in the Snake River Basin in 1992 were being marked with adipose fin clips and coded-wire tags (CWT), it was decided that this situation would afford an opportunity to test the ventral fin clip as a mass mark. Kooskia National Fish Hatchery (NFH) was selected to be a part of the evaluation process. This study evaluates adipose and ventral fin clips by comparing different aspects of migration and survival between the two different marks. The objectives of the study were to determine if there was a difference between adipose and ventral fin clipped fish in relation to: 1) adult returns, 2) mortality during hatchery residence, 3) post-release survival to Lower Granite Dam, and 4) migration time to Lower Granite Dam.

Site Description

Kooskia NFH is located approximately 1.5 miles southeast of Kooskia, Idaho, near the confluence of Clear Creek and the Middle Fork of the Clearwater River (Figure 1). The hatchery was built by the U.S. Fish and Wildlife Service in 1966 for reaaring and releasing spring chinook salmon into the Middle Fork Clearwater River (U.S.Fish and Wildlife Service 1983). Kooskia NFH has six Burrows ponds (17' x 80') that can use either raw creek water or well water with a reuse system. A chiller is also available to chill well water for use with the reuse system. Twelve 8' x 80' raceways that use raw creek water are also available. Thirty two rectangular and 32 circular fiberglass tanks are available for rearing fry using well water on a single pass or reuse basis. The present production capacity of Kooskia NFH is approximately 600,000 smolts at 20 fish/lb or about 30,000 lbs.

Methods And Materials

The experiment was set up with 349,377 juvenile spring chinook salmon divided among 12 separate raceways. The raceways were divided into two treatment groups of six contiguous raceways each, an adipose fin clip group and a left ventral fin clip group. In setting up the experiment, it was assumed that there was no significant differences between raceways.

To compare adult returns between treatment groups (Objective 1), all fish in the experiment were marked with coded-wire tags. Usually, about 60,000 fish are needed in a coded-wire tag group in order to get enough adults back for meaningful comparisons. Therefore, sets of two adjacent raceways in each treatment group received the same wire code resulting in three coded-wire replicates for each treatment group (Table 1). All the fish in each treatment group were fin clipped at the time they were marked with coded-wire. Adult return data was not statistically analyzed because of the paucity of adult returns.

The mean post-marking mortality during hatchery residence (Objective 2) was compared between the two treatment groups using the two-sample T-Test (Wilkinson 1990). The post-marking mortality for each coded-wire tag group was used to calculate means for each treatment.

Post-release survival to Lower Granite Dam (Objective 3) was determined by marking 600 fish in each treatment group with Passive Integrated Transponder (PIT) tags (Prentice et al. 1990). Statistical replication was obtained by marking 200 fish in each coded-wire tag group. An estimate of minimum survival to Lower Granite Dam was obtained by accumulating the unique PIT-tag interrogations at Lower Granite, Little Goose, and McNary dams. Using the cumulative percentages, statistical comparisons of detection rates were made between raceways within treatments and between treatments using a chi-square test for goodness-of-fit (Conover 1971).

Migration time to Lower Granite Dam after release (Objective 4) was compared between raceways within treatments using ANOVA (Wilkinson 1990). Mean migration times between treatments were compared using the two-sample T-Test (Wilkinson 1990).

Results

Of the nearly 177,000 coded-wire tagged fish marked with the adipose fin clip, only four tagged adults were recovered, three II-ocean fish and one III-ocean fish. Of the nearly 173,000 coded-wire tagged fish in the left ventral fin clip group, only three tagged adults were recovered, one I-ocean fish and two II-ocean fish. The percent returns for these two groups were 0.00225 and 0.00173, respectively.

There was no significant difference in post marking mortality between the two fin clip groups (P=0.411). One group of ventral fin-clipped fish (raceways 9 and 10) had a higher mortality rate than other groups, but the mortality was distributed over time and was not concentrated in just one raceway.

Cumulative interrogation rates for adipose and left ventral fin clipped treatments were 47% and 43%, respectively (Table 2). No significant differences were observed in interrogation rates between raceways within treatment groups or between treatment groups.

No significant differences in mean migration times to Lower Granite, Little Goose, or McNary dams were observed between groups (Table 3). Migration times to Lower Monumental Dam were not included since it did not have an operational interrogation facility until 5-5-93.

Discussion

In the literature we review where left ventral fin clips were compared with adipose fin clips, researchers usually found no significant differences either between the two types of fin clip or between clipped and unclipped control groups (Armstrong 1949; Shetter 1952, 1967; Calkins 1959; Stolte 1973; Gjerde and Refstie 1988; Johnson and Ugedal 1988; Coombs et al. 1990). In one study where adult returns were compared, Stolte (1973) found no significant differences between groups of coho salmon marked with a left ventral fin clip only, those marked with an adipose fin clip only, and unclipped controls. Unfortunately, we did not have sufficient numbers of coded-wire tagged adults return in our study to make any reasonable conclusions about the effects of fin clipping on adult returns.

Although a number of researchers concluded that clipping the left ventral or adipose fins have little or no significant affect on fish, some researchers do not agree. Shetter (1967) found that rainbow trout which were finclipped had significantly lower survival than unclipped fish. Mears and Hatch (1976) found that the overwinter survival of fingerling brook trout was highest for unclipped controls followed by those with only the adipose fin removed. Groups with only one fin clipped, including the left ventral fin, had higher survival than groups with two fins removed, but still had lower survival than those with only the adipose fin removed or unclipped fish. Hansen (1988) observed that wild Atlantic salmon that were adipose fin clipped had significantly lower survival than unclipped controls. However, the authors attributed the higher mortality primarily to handling and anaesthesia rather than to clipping the fins. Vincent-Lang (1993) compared the relative survival of unmarked coho salmon with groups marked with removal of the left ventral fin and groups marked with the removal of the adipose fin and a coded-wire tag. Groups with the left ventral fin removed had significantly lower adult returns than the adipose fin clipped group.

Summary

We found no significant differences in pre-release or post-release mortality or in migration rate to lower Snake River dams for groups of juvenile spring chinook salmon marked with a left ventral fin clip versus an adipose fin clip. The results of this paper are similar to previously published research although not all the literature is in agreement. Only two of the previously published papers evaluated adult returns for anadromous fish and each came to different conclusions. Our results suggest that either adipose or left ventral fin clips can be used for mass-marking spring chinook salmon with no difference in overall performance of juvenile fish. We did not recover sufficient numbers of adults from the study to reach conclusions about the effects of fin clipping on adult returns. Results of this study should be considered preliminary; several years of data should be evaluated before large-scale changes in mass marking are undertaken based on these results.

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Table 1. Coded-wire tag and mortality information for spring chinook salmon at Kooskia NFH, 1993

Treatment	Raceways	Tagcode	Number Marked	Post Mark Mortality	Percent Mortality %	CWT Retention %	Fin Mark Quality %	Partial Clips %
Left Ventral Fin Clip	5 and 6	52928	57,811	812	1.4	99	99	22
	7 and 8	52929	57,405	761	1.3	92	97	10
	9 and 10	52930	57,311	1,877	3.3	93	97	57
Adipose Fin Clip	3 and 4	52925	61,464	879	1.4	74	100	0
	1 and 2	52926	57,607	839	1.5	77	100	0
	11 and 12	52927	57,779	772	1.3	85	100	0

Table 2. Number (N) and percent (%) of PIT-tagged spring chinook salmon smolts in the fin clip evaluation study at Kooskia NFH in 1993 that were interrogated at juvenile collection and by-pass facilities in the Lower Snake a Columbia River.

			Interrogations									
		Number	GRJ[1]		GOJ[2]		LMJ[3]		MCJ[4]		Total	
Treatment	Raceway	Released	N	%	N	%	N	%	N	%	N	%
Adipose Fin Clip	2	197	58	29	15	8	11	6	9	5	93	47
	3	200	64	32	13	7	13	7	8	4	98	49
	11	197	50	25	16	8	10	5	11	6	87	44
Left Ventral Fin Clip	6	200	52	26	20	10	5	3	8	4	85	43
	7	200	62	31	17	9	13	7	6	3	98	49
	10	200	55	28	11	6	5	3	7	4	78	39
Totals												
Adipose Only		594	172	29	44	7	34	6	28	5	278	47
Left Ventral Only		600	169	28	48	8	23	4	21	4	261	43

1 Lower Granite Dam

2 Little Goose Dam

3 Lower Monumental Dam (started operating May 1993)

4 McNary Dam

Table 3. Mean (_), standard deviation (SD), minimum (MIN), and maximum (MAX) migration times, in days, to various juvenile collection and by-pass facilities in the Lower Snake and Columbia rivers for spring chinook salmon from Kooskia NFH in 1993 as part of a fin clip evaluation study.

		GRJ[1]					GOJ[2]					MCJ[3]				
Treatment	Raceway	N	_	SD	MIN	MAX	N	_	SD	MIN	MAX	N	_	SD	MIN	MAX
Adipose Fin Clip	2	58	18	5.7	9	45	15	21	5.3	12	31	9	32	5.5	24	42
	3	64	18	5.4	8	30	13	26	12.5	10	59	8	29	6.2	17	37
	11	50	20	8.0	11	64	16	22	9.1	10	44	11	30	5.0	22	42
Left Ventral Fin Clip	6	52	19	7.5	5	45	20	21	9.5	10	47	8	28	5.5	18	33
	7	62	19	7.9	8	54	17	21	4.3	10	29	6	29	5.2	18	32
	10	55	20	5.6	9	35	11	21	3.9	16	30	7	32	5.9	26	44
Totals																
Adipose Fin Clip		172	19	6.4	8	64	44	23	9.3	10	59	28	31	5.5	17	42
Left Ventral Fin Clip		169	19	7.0	5	54	48	21	6.8	10	47	21	29	5.6	18	44

1 Lower Granite Dam
2 Little Goose Dam
3 McNary Dam

Appendix I